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(MAGNETO)THERMOPOWER AND THERMAL CONDUCTIVITY IN OXIDES AND SULFIDES*

According to their low toxicity and robustness against oxidizing conditions, thermoelectric ceramics of transition metal oxides or sulfides have been studied by many research teams over the world. The p-type oxides such as layered cobaltites $Na_xCo_2O_4$ or $[Bi_{1.7}Co_{0.3}Ca_2O_4]^{RS}{}_{0.6}CoO_2$ [1, 2], perovskite and hollandite ruthenates $SrRuO_3$, $ACu_3Ru_4O_{12}$ (A = Na, Ca, $Ca_{0.5}La_{0.5}$, La) and $A_{1.5}Ru_{6.1}Cr_{1.9}O_{16}$ (A = Sr, Ba) [3–5], exhibit a spin driven contribution to the thermopower which can be revealed by magnetothermopower (MTEP) measurements.

We have more recently shown for the first time that MTEP effect also exists in magnetic sulfides such as the $CuCrTiS_4$ spinel SPS densified ceramic [6]. These results allowed to generalize the effect of magnetism on the Seebeck coefficient (S).

This is in marked contrast with the control of the thermopower by tuning the charge carrier concentration in n-type oxides as $Zn_{1-x}In_xO$ [7] and sulfides as Fe_xTiS_2 [8]. For the latters, the chemical substitution or intercalation are efficient to reduce the lattice part of the thermal conductivity (κ_l) as well as to optimize the power factor (S^2/ρ, where ρ is the electrical resistivity). In that respect, the pyrites family is an interesting system as in this simple cubic structure, κ_l can be drastically reduced by doping such as the Cu effect in NiS_2 [9] (Fig. 1).

Through several examples, including tellurides such as the Sb_2Te_3/graphite nanocomposites [10], the different routes to improve the thermoelectric properties of thermoelectric dense ceramics will be proposed.

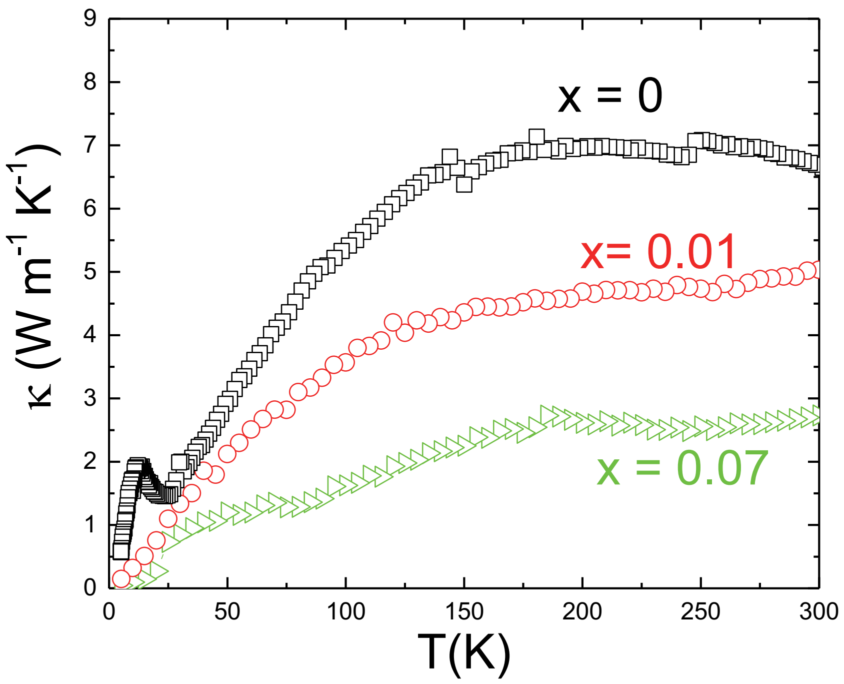

Fig. 1. Thermal conductivity κ of $Ni_{1-x}Cu_xS_2$ ceramics; with 7%-Cu only, κ is decreased by a factor of 2 at RT

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